ON HORNBLENDE ANDESITES FROM THE NEW VOLCANO ON BOGOSLOFF ISLAND IN BERING SEA.

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The rocks described below were received from Lieut. G. M. Stoney, by whom they were collected and donated to the National Museum. On account of the interest just now attached to the locality they seem worthy of a special description. It is well to remark in the beginning that none of the samples received show freshly fractured surfaces, but are in the form of irregular blocks with their corners broken and rounded. They were accompanied and covered with a fine sand and dust of the same mineral nature as the rocks themselves, but stained by sulphur and iron oxides. Even in the absence of definite information on the subject it seems safe to infer that they are simply ejected volcanic blocks, and not from recent lava flows, none of which have as yet been reported.

Two varieties of the rock were received, one consisting of a light-gray slightly purplish, fine grained and porous groundmass, in which small glassy feldspars and dark brown and green hornblende-like crystals are readily distinguishable by the naked eye. The texture is quite uniform, the brown hornblende being the more variable constituent, in one case a single crystal nearly half an inch in diameter being observed. The rock is rough to the touch and somewhat friable. Under the microscope it is found to consist of a light gray groundmass, in which are embedded deep reddish brown, strongly dichroic hornblendes, light green augites, and numerous crystals of a plagioclase feldspar, together with scattering grains of iron ore. The hornblendes are usually in irregular crystals, though an occasional quite perfect basal section was observed which showed a preponderance of the prismatic faces. The crystals are often elongated in the direction of their vertical axes, and a portion of them show the dark borders so commonly seen in the hornblende of andesites. The augite is light green in color and at first glance might readily be mistaken for a green variety of hornblende. Its cleavage and optical properties are, however, unmistakably those of augite.

In form the plagioclases are short and thick, showing but few twinning striations, sometimes none at all. A portion of them are clear and pellucid, while others are clouded through the presence of numerous cavities and impurities. In many cases the outer portion of a crystal is clear, while the interior is clouded, or again, both outer and interior portions may be clear while there exists an intermediate zone full of cavities. In addition to these the plagioclases contain numerous inclosures of a yellowish glass, which often bears a bubble, and hornblende and augite particles. A number of short and thick, clear, glassy feldspars are present, which show no sign of twinning, and which appear from their optical properties to be sanidin. Both sanidin (?) and plagioclase show at times a very evident zonary structure.

Apatite occurs but sparingly and in minute colorless crystals, showing but slight trace of the dusky interiors so often seen in the apatites of this class of rocks. The magnetite is, as a rule, in but poorly defined crystals.

The base proper of the rock consists of an aggregate of minute colorless microlites* and grains of opacite; there is also present a very weakly doubly refracting, colorless, interstitial substance, which, under a power of 300 diameters is seen to be composed of rounded and irregular imbricated scales like tridymite. So far as observed, however, none of these scales present a regular hexagonal outline, but resemble more closely those figured by Rosenbusch† than any I have seen figured elsewhere.

The dark variety of the rock is much more compact in texture, and bears a larger proportion of microscopic hornblende, which occurs in crystals of all sizes up to one-fourth of an inch in diameter. Under the microscope it is found to contain also a much greater proportion of minute feldspars scattered through the groundmass. As in the lighter variety, these are short and thick, being usually not more than twice as long as broad. The groundmass is much more dense, but under a high magnifying power is seen to consist mainly of the same colorless microlites and iron-ore. Little, if any, tridymite is present and no true glass was observed. In other respects the varieties seem nearly identical.

Samples of the rock submitted to Dr. T. M. Chatard, of the Geological Survey, for chemical analysis, yielded results given below:

[I is the light-colored tridymite-bearing variety; II, the dark variety.]

	I.	II.
Ignition	.99	.34
SiO_2	56.07	51.54
TiO_2	1.24	.32
Al_2O_3	19.06	20.31
Fe_2O_3	5.39	4.64
FeO	.92	3.56
MnO	.23	.32
CaO	7.70	9.55
MgO	2.12	3.16
P_2O_5	.16	.57
Na_2O	4.52	4.29
K_2O	1.24	2.47
	99.64	101.07

The low percentage of silica in the rocks is especially interesting, and would seem to point to the presence of very basic plagioclases. To satisfactorily determine this point an attempt was made to separate the feldspars from both rocks by means of the iodide of mercury and potassium solution. At a specific gravity of 2.7 a considerable quantity

*In a preliminary note on these rocks, published in Science of December 12, 1884, the base was stated by mistake to be *microfelsitic*. It should have read *microlitic*.

†Mikroscopische Physiographie der Mineralien, &c., p. 227.

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of the powder from the light variety came down, which, on examination with the microscope, proved to be nearly all feldspar, with small portions of the groundmass, and included iron-ores and hornblende particles. After standing over night a further precipitation was observed to have taken place, which, on examination, proved to be very pure feldspar. A sample of this last submitted to Professor Clarke for further examination yielded 55.29 per cent. of silica, which is about the right proportion for labradorite. Owing, however, to the somewhat crude method of separation, I do not feel at all certain that this is the only feldspar present, and it is very probable that with better facilities other results might be obtained. It is possible that the first portion to come down may have been anorthite, as suggested by Mr. Diller in Science of January 23, 1885.

With the dark variety of the rock no satisfactory results could be obtained, it being found impossible to separate the very impure feldspar from the groundmass with any facilities at my command.

Especial thanks are due Professor Clarke and Dr. Chatard for the excellent chemical work done by them in this connection.

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NOTE.—In Science of May 30, 1884, Mr. J. S. Diller, of the U. S. Geological Survey, reports on a sample of volcanic sand that fell at Unalashka October 20, 1883, and which was regarded as doubtless a product of the same volcano as the andesite now under consideration. This sand gave on analysis 52.48 per cent. of silica, and, reasoning from the stand-point that in process of cooling the most basic minerals of a lava will be first to crystallize, and hence on being blown into fragments will give rise to a coarser powder than the more siliceous and still glassy portions, he suggests that in the case in hand the fine siliceous dust had been separated out by wind currents and carried to a greater distance before deposition. The sand remaining thus failed to give a correct showing regarding the acidity of the rock from which it was derived.

In Science of January 23, 1885, after learning the results of the silica determination in analysis II as given above, Mr. Diller expresses surprise at the seemingly anomalous case in which a lava is as a whole more basic than the sand derived therefrom. From an examination of the Unalashka sand, however, which Mr. Diller has kindly loaned me, I am convinced that it represents the finely divided state of the lighter-colored and more acidic lava, that given in analysis I, and bears no relation to the darker and more basic variety. Indeed, a comparison of the groundmass of the two rocks is in itself sufficient to show that the sand examined by him could only originate from the lighter-colored rock. Mr. Diller's first suggestion therefore still holds good.